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A CRITICAL APPRAISAL OF

SOURCE SELECTION PROCEDURES

AFIT/GSM/SM/79S-10

John N. Milligan
Captain, USAF

AFIT/GSM/SM/79S-10

A CRITICAL APPRAISAL OF SOURCE SELECTION PROCEDURES

THESIS

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

in Partial Fulfillment of the

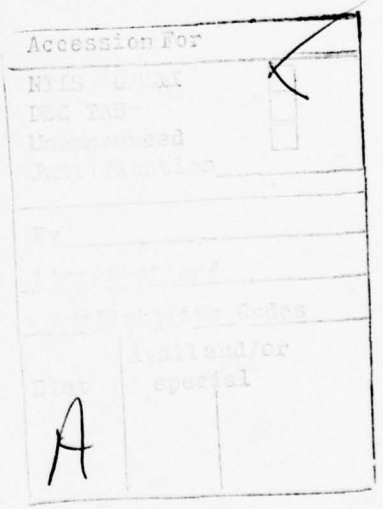
Requirements for the Degree of

Master of Science

by

John N. Milligan, B.S., M.B.A.
Captain, USAF

Graduate Systems Management



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Preface

This research effort would not have been possible without the help, support, and guidance of many people. I wish to express my particular appreciation to Lieutenant Colonel Adrian M. Harrell, who sparked my initial interest in this topic and provided an initial contact at the Deputy for Aeronautical Equipment. His undaunted enthusiasm was always an inspiration.

In addition, I wish to thank Lieutenant Colonel Edward J. Dunne, Jr., my advisor. His accurate criticism and unfailing attention to detail greatly improved the overall quality of this thesis.

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Most of all, I wish to thank my wife, Kristi. Without her, I never would have made it. She endured endless hours of complaining and always offered support. Her love enabled me to sit down and write even though I was extremely frustrated.

John N. Milligan

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Abstract

Multiple linear regression techniques were employed to examine source selection in an Air Force procurement division. The experimental data was derived from an exercise which examined a part of the source selection process. Each exercise contained identical Request for Proposals. Subjects were asked to rate proposals with and without a policy (prioritizing evaluation criteria). The results of the exercise were grouped three ways: (1) by organization, (2) by supervisory level, and (3) by experience with source selection. All possible pairings within the above three categories were then compared to identify any significant differences between sub-category members. All groupings were investigated to determine whether or not each evaluation criteria contributed significantly to the rating a proposal received. Assimilation of the policy (prioritizing evaluation criteria) was examined. Last, the linear model was compared to a non-linear model to determine whether or not the linear model was adequate. —> next page

The linear model was proven to be acceptable in modeling this source selection decision. Significant differences in how each organization rated proposals were discovered. Supervisory level did not yield any significant differences in rating proposals. There were differences in how those who had participated in source selection and those who had not rated proposals. All of the evaluation criteria did not contribute significantly to proposal rating when subjects were given a prioritized listing of evaluation criteria or policy. There was no difficulty in assimilating a policy and no significant difference in degree of policy

assimilation. These results suggest that source selection decisions are not similar across organizations within the Air Force division. Furthermore, subjects did not utilize all the information available to them in making decisions. People often chose to utilize only a part of the available information in arriving at a decision.

A CRITICAL APPRAISAL OF SOURCE SELECTION PROCEDURES

CHAPTER I

INTRODUCTION

Source selection is an activity performed by many systems program managers. While it represents only one of the tasks associated with program management, it is perhaps one of the most interesting aspects of the job. When accomplishing a procurement limited to a less than "major" dollar amount, the source selection process affords program managers the opportunity to exercise judgment and exert influence. This opportunity is not available in some of the other tasks associated with program management. The authority is vested in higher levels of management as the dollar amount of a program increases.

This thesis will examine actions of program managers and supervisors in the Deputy for Aeronautical Equipment (AE), Aeronautical Systems Division (ASD), Wright-Patterson Air Force Base, Ohio. Major concentration will be on examining how source selection decisions are made when authority has been delegated as far downward as possible. The area of interest is source selection decisions under conditions of maximum freedom. Maximum freedom is attained where less than "major" programs are to be procured. In Table I, the thresholds, which determine the delegation of source selection authority (SSA) for AE, are presented.

Source Selection

Source selection specifically includes ". . . soliciting and evaluating offerors' proposals and . . . selecting sources for development

TABLE I

Delegation of Source Selection Authority*

Potential Program Cost	Source Selection Authority
$0 - $500,000 RDT&E and/or $0 - $5,000,000 Production	Procuring Contracting Officer (PCO) without power of redelegation
$500,001 - $1,000,000 RDT&E and/or $5,000,001 - $7,500,000 Production	Chief of the Procurement Division of the 3 letter organization without power of redelegation
$1,000,001 - $12,500,000 RDT&E and/or $7,500,001 - $25,000,000 Production	Director/Deputy Director/Assistant Director of the 3 letter organizations without power of redelegation
$12,500,001 - $25,000,000 RDT&E and/or $25,000,001 - $50,000,000 Production	Deputy/Assistant Deputy

*AE Operating Instruction 70-2

and production of major defense systems, subsystems, and components as well as other major programs or projects competitively procured by the Department of the Air Force" (AFR 70-15, 1976:1). Source Selection Policy and Procedures, AFR 70-15, establishes policy, assigns authority and responsibilities, and prescribes implementing procedures for source selection (AFR 70-15, 1976:1).

AFR 70-15 establishes procedures for "major" programs. A major program requires $75 million or more Research, Development, Test, and Evaluation (RDT&E) funds or is projected to require $300 million or more production funds (including support) (AFR 70-15, 1976:1-1). There are other dollar thresholds which, when exceeded, require the application of AFR 70-15. This thesis will consider source selection requiring funds which do not exceed these AFR 70-15 thresholds.

An explanation of terms is now presented in order to enhance an overall understanding of the source selection process. A complete explanation of terms will not be attempted. However, AFR 70-15 contains all terms and can be used as a reference.

1. Source Selection Process. The formalized process employed in competitive, negotiated procurements for programs. The source selection process is designed to insure an impartial, equitable, and economic evaluation, and comparative analysis of competing offerors' proposals and their capabilities. This provides an objective basis for the SSA to select the source(s) which best satisfies the government's requirements.

2. Request for Proposal (RFP). The RFP is the formal document used to invite contractors to submit proposals for required

supplies and services. It is the medium by which potential sources are introduced to the job and sets the stage for the proposals, evaluation, and contract definitization (ASD Reserve Project Number 78-017-B1, 1979:1).

3. Evaluation Criteria. The standards used in the source selection process to measure proposal acceptability in regard to the government requirements stated in the Request for Proposal.

4. Source Selection Authority (SSA). The official designated to direct the source selection process, approve the source selection plan, select the source(s), and announce the contract award.

5. Source Selection Advisory Council (SSAC). A group of senior military or government civilian personnel designated to serve as the staff and advisors to the SSA during the source selection process. They analyze, for the SSA, the results of the Source Selection Evaluation Board (SSEB).

6. SSAC Analysis Report. A formal report which contains the overall analysis of the SSAC in the form of relative strengths, weaknesses, and risks, prices or costs, overall technical effectiveness, risk analysis, offerors' capabilities, energy effectiveness, environmental awareness, negotiation results, and other appropriate factors.

7. Source Selection Evaluation Board (SSEB). A group of military and/or government civilian personnel, representing the various functional and technical disciplines for a procurement appointed by the SSAC to direct, control, evaluate proposals, and develop summary facts and findings.

8. SSEB Evaluation Report. This report, prepared by the SSEB, contains evaluation standards, detailed narrative assessments of each proposal against these standards, numerical scores when used, and summary appraisals of significant strengths, weaknesses, and risks of each proposal. It forms the basis of the SSAC analysis.

9. Source Selection Officer. A staff officer who advises the organization commander on source selection policies and procedures. He also advises the Program Manager, SSA, SSAC, or SSEB on how to properly conduct a course selection.

10. Procurement Evaluation Panel (Review Board). A group of highly qualified government officials that review Requests for Proposals and other documentation for selected procurements to assure that excessive or nonessential technical, management, and/or procurement related requirements are eliminated, that the RFP sets forth clearly what the government plans to buy, and that business management considerations are assessed (AFR 70-15, 1976:1-1 - 1-3).

These definitions apply to major source selection where structured procedures are required. AFR 70-15 permits considerable flexibility for those programs falling below the major program financial thresholds. The following quote emphasizes this fact. "Policies and procedures contained in this regulation are sufficiently flexible to accomodate a wide range of requirements. They, therefore, may be used as a guide to formally evaluate competitive proposals and to select sources for other programs/projects below the dollar thresholds prescribed above" (AFR 70-15, 1976:1-1).

Small dollar procurements are usually involved in projects/programs in AE, and are also typical of many other program offices. This motivated ASD to publish ASD Pamphlet 800-7. Its objective is to "streamline, simplify, and improve the effectiveness of the source selection process" (ASDP 800-7, 1978:1-2). It specifies procedures which are to be employed for less than major source selections. Although less formalized, small source selections utilize procedures similar to those in major source selections.

The Procurement Evaluation Panel was mentioned in the definitions. As authority is delegated downward, the SSA eventually rests with the Procuring Contracting Officer (PCO). In small programs typical of AE, the PCO assumes the responsibilities of the Procurement Evaluation Panel. The PCO has three responsibilities: (1) control all communication between the government and offeror, (2) assure that the basis for fully acceptable contracts are negotiated with responsible offerors, and (3) assure sound procurement practices are adhered to throughout the entire source selection process (AEOI 70-2, 1978:5).

Organizational arrangements are altered as stated in ASDP 800-7. Significant changes have been successfully instituted where the SSA has been delegated to the division commander. The SSAC and SSEB are deleted. Instead, a small group of evaluators are carefully selected to participate as members of an evaluation body designated as the Evaluation Committee (EC) (ASDP 800-7, 1978:7). ASDP 800-7 describes the duties of these evaluators. "Evaluators are responsible to the Chief of the EC and, in turn, to the SSA for their contributions and

conduct during the course of the preparation of the RFP, proposal evaluation, and completion of the selection process" (ASDP 800-7, 1978:7).

As the dollar amounts are further reduced, the EC is dispensed with. The following quote, from a Systems Command Supplement to AFR 70-15, explains why. "Formalized source selection procedures for procurements with a projected contract dollar value below $1 million are discouraged. Rather, regular ASPR award procedures (3-805 and 4-106) are encouraged for procurements where the complexities and risks do not require the use of formalized source selection procedures" (AFR 70-15, AFSC Sup 1, 1977:1). An attempt will be made to examine source selection in this relaxed atmosphere.

In this thesis an examination of a part of the source selection process will be undertaken. Program managers and their supervisors will be administered an exercise requiring them to evaluate an RFP. Each proposal will have been rated in relation to five evaluation criteria when presented for evaluation. This task of evaluating a proposal is representative of the type of decision required of program managers and supervisors in source selection.

A typical program/project in AE might be below $1 million. Thus, the theoretical source selection in this research will be of such a size; a $400,000 program for RDT&E. The SSA will be the Procuring Contracting Officer in accordance with AEOI 70-2. This $400,000 figure is below the $500,000 threshold for RDT&E. Thus, the SSA is delegated to the lowest possible level of authority within AE. Such a delegation often occurs.

In Appendix A, a list of source selection actions is provided for information. It states actions required when using an Evaluation Committee. An Evalation Committee will not be required for the theoretical $400,000 source selection. However, even when not using an Evaluation Committee, it is desirable for the program manager to follow as closely as possible the actions which the committee would have taken. Maximum effort went into design of the formal procedures associated with major programs. Past errors were considered when constructing the formal regulations.

Criteria for evaluation of proposals are stated differently in AFR 70-15, ASPR 3-501, and ASPR 4-106.4. The significant factors, regardless of how they are stated, continually recur. The following five criteria are a distillation of statements in AFR 70-15 and ASPR: (1) technical, (2) operational, (3) logistics, (4) management, and (5) cost. These five criteria will be used to evaluate source selection decision making.

Statement of the Problem

There are five organizational units within AE which utilize program managers. These are Avionics and Aircraft Accessories Systems Program Office (SPO)-AEA, Life Support SPO-AEL, Reconnaissance/Strike SPO-AER, and Electronic Warfare SPO-AEW. The specific intent is to evaluate source selection decision making within these organizations. In addition, an examination and comparison of decisions by program managers and their immediate supervisors will be undertaken.

The part of source selection to be examined is one of the actions which would normally be performed by the Evaluation Committee; evaluating proposals which have already been rated in relation to specific evaluation criteria. In a less than major source selection, the program manager or his direct supervisor could be responsible for accomplishing this task. By choosing to evaluate decision making in less than major source selections, research is constrained to an area representative of AE. All of AE's program managers are familiar with this type of source selection.

Specific hypotheses to be tested are:

H1: Evaluation criteria are weighed consistently by personnel within AE.

H2: There are no differences among AE three letter groups with respect to source selection decisions.

H3: There is no difference in source selection decisions made by program managers and their direct supervisors.

H4: Source selection decisions, in the aggregate, are highly predictible using only two or three of the five evaluation criteria.

H5: Program managers and their direct supervisors will be able to assimilate a policy prioritizing evaluation criteria.

H6: Program managers and their immediate supervisors will assimilate and apply a policy to the same degree.

H7: Three letter groups will assimilate a policy to the same degree.

H8: There is negligible difference in the amount of variance explained by linear and non-linear models.

Assumptions

The assumption is made that correct or representative evaluation criteria have been identified prior to conducting the source selection decision making exercise. This is necessary for the results of the analysis to be meaningful.

Limitations

There are approximately 122 program managers, 30 of which are supervisors. An attempt will be made to administer the exercise to each of them. Thus, full coverage or representative coverage will be obtained for a specific organizational unit within Aeronautical Systems Division.

In the next chapter, Methodology, the construction of an exercise to analyze source selection is discussed. Then, the techniques used in evaluating the results of the exercise are presented.

CHAPTER II

METHODOLOGY

Modeling the Source Selection Decision

In Chapter I, the judgment to be modeled was identified. In addition, five evaluation criteria, henceforth cues, were presented. The next problem is how to construct an exercise using these cues to analyze a source selection decision. Multiple linear regression is a very powerful tool which can be used to accomplish this task.

The first use of linear models was proposed by Benjamin Franklin in 1887. In a letter to his friend, Joseph Priestly, Franklin advocated the use of what he called moral or prudential rules in arriving at decisions. He specified how to apply a linear technique in making decisions (Dawes & Corrigan, 1974:95). In 1923, Henry A. Wallace proposed building a linear model to represent a corn judge's actions (Dawes & Corrigan, 1974:100). Brunswik (1940) proposed the use of multiple regression as a model for human use of information. Hoffman proposed that linear models could be used to represent expert judgment (Hoffman, 1960:116).

Since the time of Brunswik, linear analysis has been applied to depth perception, person perception, clinical inference, and conflict resolution. The regression technique has also served as a model for examining ability to detect and use correlations in quantitative prediction tasks (Beach, 1967:277). Slovic and Lichtenstein cite over 30 studies illustrating the tremendous diversity of judgmental tasks to which the model has been applied (Slovic & Lichtenstein, 1971:677).

In the Air Force, multiple regression has been applied in a variety of situations. The difficulty level of jobs within the Medical Materiel Career Ladder was adequately determined using a three-variable regression equation (Mead, 1970:iii). Multiple regression was also used to evaluate the job difficulty of Accounting and Finance supervisors (Mead and Christal, 1970:1). Multiple regression was also used at the United States Air Force Academy to evaluate and improve the cadet rating system (Taylor, 1976:217). It has also been used in several AFIT thesis efforts.

Applicability of the Linear Model

Bottenberg and Ward (1963) state that:

> If it is possible to obtain all the information available to decision-makers and an adequate sample of their decisions, we usually can formulate a regression model that satisfactorily accounts for the decisions.

This process of weighting and combining information (often referred to as cues) can be represented by an equation of the form

$$Y = b_1X_1 + b_2X_2 + \ldots + b_iX_i$$

where Y is the judgment, X_i is the value of the ith cue, and b_i represents the importance of the ith cue (Slovic and Hoffman, 1969:2). The b_i are often called beta weights.

Even if it were possible to obtain all information available to the decision maker, often the decision is made in the face of uncertainty. The question then arises, can multiple linear regression do an adequate job under these circumstances. Beach (1967) makes the assumption that men must attempt to function effectively in an environ-

ment about which they receive only equivocal information. He states that when faced with this type of situation, "Multiple regression is used as the model for optimal use of the equivocal information" (Beach, 1967:278). In further support of multiple linear regression, Dawes and Corrigan state that, "It is not surprising that linear models outperform intuitive judgment" (Dawes and Corrigan, 1974:105). Thus, the literature provides a strong support for the application of linear models to decision making processes. This model has been used in describing decisions or as a substitute for the decision maker.

The Use of Cues

Most of the important stimuli about which judgments are made are multidimensional. A cue, information bit, component attribute, or dimension characterizes this multidimensional stimulus (Slovic and Hoffman, 1969:1). Thus, in simple language, a cue is a piece of information to be utilized by the decision maker.

A question which often arises is how many cues to provide the decision maker. Another concomitant question is how many levels or dimensions to provide each cue. Slovic and Lichtenstein warn against using too many cues. In their study, increased numbers of cues led to decreased accuracy. The following quote emphasizes this:

> In summary, there is a small amount of evidence that increasing the amount of information available to the decision maker increases his confidence without increasing the quality of his decisions and makes his decisions more difficult to predict. (Slovic and Lichtenstein, 1971:687)

Linear vs. Non-linear Models

Numerous examples citing the strength of the linear model have been presented. At this point, some questions about non-linearity will be examined. The question is: Do subjects combine cues in a linear or non-linear fashion? Brehmer states there is little evidence that humans use information is any other than the linear, additive (or averaging) one. He further asserts that "Still, the majority of the studies indicate that most or all the variance in his (the subject's) response system can be accounted for by a linear multiple-regression equation" (Brehmer, 1969:491).

Numerous studies have uncovered instances of interactions among cues. Even when these interactions are present, Slovic and Lichtenstein assert that "The linear model accounts for all but a small fraction of predictable variance in judgments across a remarkably diverse spectrum of tasks" (Slovic & Lichtenstein, 1971:681). Thus, a minimum of time will be spent on non-linear considerations in this research effort.

Relative Weights

Hoffamn identified three limitations with using beta weights in multiple regression. These are (1) direct comparisons of sets of betas between subjects is not meaningful, (2) beta coefficients do not account for all the predictable variance, and (3) beta coefficients do not allow for the assessment of the independent contribution of each predictor (Hoffman, 1960:120). Therefore, he advocated the use of relative weights and defined them as

$$RW_{iy} = \frac{b_{iy} r_{iy}}{R_y^2}$$

where

b_{iy} = the beta coefficient for the ith predictor

r_{iy} = the validity coefficient (correlation with judgment) of the ith predictor

R_y^2 = the squared multiple correlation coefficient for subject Y (Hoffman, 1960:121).

Slovic and Lichtenstein point out that "Since the sum of the relative weights is 1.0, Hoffman's index describes the relative contribution of each of the predictors as a proportion of the predictable linear variance" (Slovic & Lichtenstein, 1971:658).

To the researcher who is primarily interested in relative weights, orthogonal designs often seem preferable to designs in which the cues are correlated in a representative manner. "One device used to insure orthogonality has been to construct stimuli by producing factorial combinations of the cues" (Slovic & Lichtenstein, 1971:658). Such a design was employed when constructing the source selection exercise for this thesis. With this design $r_{iy} = b_{iy}$ so the equation for computing the relative weights reduces to

$$R_{iy} = \frac{(b_{iy})^2}{R_y^2} .$$

Identification of the Problem

Interviews, with three letter chiefs within AE, were conducted to learn more about problems within the source selection process. In addition, all the source selection regulations and documents utilized by personnel within AE were obtained. Five evaluation criteria were

identified from interviews and from the regulations. Each cue was provided two levels; adequate or excellent. Lieutenant Colonel David L. Welton (AEA) offered particularly strong support on all phases of this stage of the research. He assisted in identifying and clarifying the cues. Also, he provided the contacts within AE necessary to obtain permission to conduct the source selection exercise.

Application of the Cues

The next task was to construct a source selection exercise utilizing the evaluation criteria. The intent was to model how program managers and supervisors evaluate proposals which have been rated in relation to the evaluation criteria. Since only five evaluation criteria were identified a full factorial design was employed in constructing the exercise. A design which exhausts all possible combinations of the cues is often called full factorial. Each cue was coded either excellent or adequate. Thus, the full factorial design required 2^5, or 32, decisions to exhaust all possible combinations of the cues. The exercise is provided for examination in Appendix B.

In a Request for Proposal (RFP), evaluation criteria are listed in a prioritized manner. The specific intent is for offerors to incorporate this priority when preparing proposals. One measure of how well an RFP met objectives is the degree to which the proposal incorporates the prioritized critiera. Program managers are often involved in examining this facet of a proposal.

In the first part of the exercise demographic questions were asked. The second part of the exercise required that the 32 decisions be made with no stated priority. Thus, the intent was to capture the policy of

each individual with no guidance. In the third part of the exercise, a priority of the cues was provided. Then, each individual was asked to evaluate 32 additional proposals. This allowed comparison of each individual's decisions with and without a policy.

To insure that each individual would not be able to recognize a pattern between the same 32 decisions in parts two and three, a random number table was used to determine the order of the 32 combinations of the cues. A different random number generator was used for parts two and three of the exercise.

The appropriate linear model for this study is

$$Y = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5$$

where X_1 through X_5 are the evaluation criteria, as follows:

X_1 = Technical

X_2 = Operational

X_3 = Logistics

X_4 = Management

X_5 = Cost.

In Appendix B each of the evaluation criteria is defined.

Each of the 32 proposals can be represented mathematically by orthogonal vectors. This is presented in Appendix C. Orthogonality assures that the evaluation criteria will be uncorrelated in the regression. Thus, the usefulness of the evaluation criteria in arriving at the proposal evaluation is strictly measured by the intercorrelation between each evaluation criteria and the decision (Darlington, 1962: 162). Each of the 32 evaluations made by the experimental subject is

strictly characterized by the numerical value (0, 1, . . . , 10) of his evaluation and one of 32 orthogonal predictor vectors, each of which represents a unique proposal state. It is thus simple to determine the importance the subject places on each of the five evaluation criteria with and without a policy.

Significance of R^2

R^2, the squared multiple correlation coefficient for the regression, provides information as to how well an individual's decision process was modeled. It is one of the printed outputs of Lieutenant Colonel Charles W. McNichols' computer program. The following quote defines R: "The multiple correlation (R) provides a measure of control because it measures the correspondence between an individual's judgments and predictions from a specific model" (Hammond, et al, 1977:279). Jones, et al (1976) provide an F-test to evaluate whether or not R is statistically significant. For this test,

$$F_0 = \frac{(n-k-1)R^2}{k(1-R^2)}$$

where the terms mean the following:

n = the number of decisions (32)

k = the number of cues (5)

R^2 = the squared multiple correlation coefficient. F is distributed with p and n-p-1 degress of freedom

This test was used to evaluate an individual's R in order to determine whether or not any individual's model was statistically valid.

Pre-test

In order to assess the effectiveness of the source selection exercise, a pre-test was conducted. Five subjects, one each from the five divisions within AE, participated. Four subjects completed all parts of the exercise; with and without a policy. Within one day after completing the exercise, each subject was asked to make recommendations for improvements. None of the subjects had any difficulty in understanding the directions and accomplishing the exercise. One recommendation which was incorporated was a change to the size of the theoretical proposal. It was changed from $10,000 in the pre-test to $400,000 in the actual exercise.

Pre-Test Results

Four of the five people who took the pre-test completed all sections of it. In Table II the individual and average of the individual R^2's for the four are presented.

TABLE II

Pre-Test R^2's

Case	R^2 - No Policy	R^2 - With Policy
1	.880	.855
2	.466	.837
3	.550	.515
4	.930	.957
Average	.707	.794

An F-test to test the significance of R^2 was mentioned earlier.

At the five percent significance level an F-value was extracted from tables ($F = 2.59$). One can then solve for the R^2 value which would have caused rejection of this statistic, $R^2 = .322$. None of the individuals and none of the average R^2 values fall below this figure.

A comment about responses received during the interviews after the exercise is now appropriate. The overall exercise did make sense to the test subjects. They understood what they were asked to do. The instructions were adequate and understandable. The definition of each evaluation criteria was clear. In their opinion, the evaluation criteria were typical of source selections within AE. There are not any other evaluation criteria which should be included or were thought to be more relevant than those which were used. It was not felt that an example was necessary in the instructions. Last, the decision that the subjects were asked to make was meaningful as compared with the overall kind of judgment in source selection.

The interviews after the pre-test uncovered a possible problem with the completion of the source selection exercise. A wide diversity of levels of experience exists within AE. Some program managers have never accomplished a source selection while others have accomplished many. However, all the program managers are somewhat familiar with the process. Because of the wide degree of difference in experience, two additional demographic questions were added to the exercise: (1) Have you ever been involved in an actual source selection? and (2) If so, about how many?

Administration of the Exercise

After incorporating acceptable recommendations, the exercise was distributed to 96 personnel within AE on 9 June 1979. The five participants in the pre-test were excluded. Because the initial response rate was low, a letter extending the cutoff date was distributed. The letter was written only after it was determined that leave, excessive TDY, and heavy June workloads had interferred with completing the exercise. A copy of this letter is presented in Appendix D for reference.

Coding of the Data

The data was coded to fit the format of a FORTRAN program written by Lieutenant Colonel McNichols, AFIT Systems Management Department. This program computed relative weights and coded this output, along with each individual's demographic data, onto disc. This coding to disc was necessary in order to have individual data available for regression analysis using the Statistical Package for the Social Sciences (SPSS).

Analysis of the Experimental Data

The Aeronautical Systems Division (ASD) CDC 6600 computer was used for the data analysis. It employed the SPSS multiple regression algorithm (Nie, et al, 1975). Also, Lieutenant Colonel McNichols' program was employed to compute individual relative weights with and without a policy.

The SPSS capabilities are numerous. A total of thirty seperate regression models were generated for this study. These models represent the following groups: (1) program managers with and without a policy,

(2) supervisors with and without a policy, (3) dividions one through five (1-AEG, 2-AEW, 3-AER, 4-AEA, 5-AEL) with and without a policy, (4) interaction models for the above groupings, and (5) source selection experience versus no source selection experience with and without policy. Generation of these models was quite easy using the Select If and Compute features of SPSS (Nie, et al, 1975).

Testing for Statistical Differences Between Groups

Each of the models was tested for differences among the groups. The groups examined were divisions, program managers versus supervisors, and source selection experience versus no source selection experience. A statistically significant difference would indicate that the regression coefficients represent different populations. Therefore, the importance given to the evaluation criteria by at least one group in the comparison is significantly different from the others. To accomplish this, the F-test described by Gregory C. Chow was used (Chow, 1960:599).

The null hypothesis for the Chow test is that there is no difference in the regression coefficients (b_i's) for the groups involved. The alternate hypothesis is that the regression coefficients are different for at least one pair of the groups. This is equivalent to saying that at least two of the groups utilize evaluation criteria differently in evaluating proposals. The level of significance for all F-tests in this study was .05. The method of calculating this F-test for groups is shown in Appendix E.

Deletion of Cues

A question often asked is, does the decision maker utilize all information available to him. To investigate information utilization

in source selection, cues were examined for their contribution to the rating a proposal received. In order to determine whether or not a cue could be deleted, a somewhat arbitrary 90 percent floor was established for contribution to the overall decision. In other words, the relative weights were examined for magnitude. Any cue or combination of cues contributing less than ten percent to the overall decision were dropped. The overall group, supervisors, program managers, all divisions, and individuals were examined with and without a policy.

Assimilation of a Policy

To determine whether or not the policy was assimilated, Spearman's Rho was utilized (Mendenhall and Sheaffer, 1973:549). Lieutenant Colonel McNichols wrote a FORTRAN program to calculate this value. The groups examined for policy assimilation were program managers, supervisors, and divisions.

Spearman's Rho is used to test for correlation bewteen two paired variables. The Rho, or rank correlation coefficient, tests an association between two populations. Rho (R_s) is calculated by the following equation:

$$r_s = 1 - \frac{6 \sum_{i=1}^{n} (x_i - y_i)^2}{n(n^2-1)}$$

where,

x_i = the priority (or rank order) associated with an evaluation criteria as a part of the guidance

y_i = the priority (or rank order) given to an evaluation criteria by a subject

n = the number of cues (Mendenhall and Schaeffer, 1973:550).

Spearman's Rho for each subject was calculated for parts two and three of the exercise. In part two, the subjects were given no priority. Thus, a low r_s would be expected. In part three, a priority was given. Thus, a higher value of r_s would be expected.

A paired t-test was conducted for each of the groups mentioned above. The results indicate whether groups could assimilate a policy. Specific hypotheses tested were

$$H_o: \mu_1 - \mu_2 \neq 0$$

$$H_a: \mu_1 - \mu_2 = 0$$

where,

μ_1 = the population mean Spearman Rho value for a group with no policy

μ_2 = the population mean Spearman Rho value for a group with policy.

The t-statistic is calculated as follows:

$$t = \frac{\bar{d}}{s_d/\sqrt{n}}$$

where,

x_{1i} = the Spearman Rho value for individual i with no policy

x_{2i} = the Spearman Rho value for individual i with policy

$d_i = x_{1i} - x_{2i}$

n = the number of subjects within a group

$$\bar{d} = \frac{\Sigma d_i}{n}$$

$$s_d^2 = \sum_{i=1}^{n} \frac{(d_i - \bar{d})^2}{n-1}$$ (Mendenhall and Sheaffer, 1973:446).

t has n-1 (57) degrees of freedom.

Test for Difference in Ability to Assimilate a Policy

To test for differences in ability to assimilate a policy among groups, a t-test to measure differences in group means was employed. Mean Spearman Rho values for groups (with policy) were compared. The hypotheses tested were:

H_o: $\mu_1 = \mu_2$

H_a: $\mu_1 \neq \mu_2$

where,

μ_1 = the population mean Spearman Rho value for group one

μ_2 = the population mean Spearman Rho value for group two.

The t-statistic has the following form:

$$t = \frac{\bar{Y}_1 - \bar{Y}_2}{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

where,

$\bar{Y}_1$ = the sample mean Spearman Rho value for group one

Y_2 = the sample mean Spearman Rho value for group two

n_1 = the number of subjects in group one

n_2 = the number of subjects in group two

$$s^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2}$$ (s_1^2 and s_2^2 are the sample variances for groups one and two.)

t has $(n_1 + n_2 - 2)$ degrees of freedom (Mendenhall and Sheaffer, 1973:346).

Tests for Non-Linearity

In order to test for non-linearity, interaction models were built for the following groups: program managers, supervisors, divisions, and the overall group; with and without a policy. The interaction model was constructed as described by Lieutenant Colonel McNichols (1978:4-35). A two-way interaction model was built. It was similar to the following equation:

$$Y_i = B_0 + B_1X_{i1} + B_2X_{i2} + B_3X_{i1}X_{i2}$$

All possible combinations of two-way terms were utilized. The original five evaluation criteria were included in the model. Then, two-way interactive terms which will contribute most to the model were chosen and then included in a regression. This is often called forcing in variables. For each of the groups, the increase in R^2 was then examined. In the next chapter results are presented. Analysis of demographic results is presented first. Then, analysis of hypotheses follows.

CHAPTER III

RESULTS

Results of SPSS Descriptive Statistics

As mentioned in Chapter II, for convenience the outputs of Lieutenant Colonel McNichols' FORTRAN program were coded to disc. This facilitated use of the data with SPSS programs. An initial examination of the data was conducted. Specific SPSS capabilities employed were FREQUENCIES and CROSSTABS. FREQUENCIES displays how the data was grouped. CROSSTABS checks the data groups (demographic groups) for independence (Nie, et al, 1975).

Results of FREQUENCIES will be presented first. The desire is to determine the basic distributional characteristics of each of the demographic variables to be used in the subsequent statistical analysis. The variables run were frequencies of responses (proposals rated) for demographic descriptors. The descriptors, as listed in Appendix B, were: organization, supervisor or non-supervisor, and source selection versus no source selection experience. Results for organizations are presented in Table III. Results for supervisor versus non-supervisor are presented in Table IV. Results of source selection versus no source selection experience are presented in Table V.

Second, CROSSTABS was run for individual responses with and without a policy. One of the outputs of CROSSTABS is Chi-square, which determines whether or not a systematic relationship exists between the variables. Since Chi-square increases as the number of cases increases, a

TABLE III

Distribution of Responses by Organization

Organization	Absolute Frequency of Responses	Relative Frequency (Percent)
AEG	6	10.3
AEW	16	27.6
AER	13	22.4
AEA	13	22.4
AEL	10	17.2
Totals	58	100.0

TABLE IV

Distribution of Responses by Level of Responsibility

Status	Absolute Frequency of Responses	Relative Frequency (Percent)
Non-Supervisors	41	70.7
Supervisors	17	29.3
Totals	58	100.0

TABLE V

Distribution of Responses by Source Selection Experience

Experience	Absolute Frequency of Responses	Relative Frequency (Percent)
Source Selection	42	72.4
No Source Selection	16	27.6
Totals	58	100.0

further statistic, Phi (ϕ) is often employed to correct for this. Phi has the form

$$\phi = \frac{\psi^2}{N}^{\frac{1}{2}}$$

where

ψ^2 = Chi-square

N = the number of sample cases.

"Phi takes on a value of 0 when no relationship exists, and the value of +1 when the variables are perfectly related. . ." (Nie, et al, 1975: 224). It should be noted that, while Chi-square might be statistically significant (at the five percent level), the corresponding value of ϕ might be so low as to indicate little, or a negligible, relationship. In Table VI these calculations are presented for groups with and without policy. In Table VII results for pairings of demographic groups are presented. The strongest relationship exists for R^2 versus organization. The weakest relationship exists for R^2 versus supervisory level. Without a policy, R^2 is independent of supervisory level. None of the Phi values is close to +1 so a perfect relationship does not exist for any of the comparisons in the table. Each subsequent section will deal with specific hypotheses. Hypotheses will be stated before presentation of data applicable to them.

Relative Weights

Relative weights were computed for individual subject and groups. The individual relative weights are presented in Appendix F for reference. Relative weights with and without a policy are displayed. The

TABLE VI

Tests for Independence

R^2 Versus Demographic Group

(Without Policy)

Comparison	Chi-Square	Level of Significance	Phi
R^2 versus Organization	262.10	.00	.376
R^2 versus Supervisory Level	.39	.53	--
R^2 versus Source Selection Experience	5.55	.02	.050

(With Policy)

Comparison	Chi-Square	Level of Significance	Phi
R^2 versus Organization	190.86	.00	.321
R^2 versus Supervisory Level	123.53	.00	.258
R^2 versus Source Selection Experience	64.22	.00	.186

TABLE VII

Tests for Independence Between Demographic Groups

Comparison	Chi-Square	Level of Significance	Phi
Organization versus Supervisory Level	76.52	.00	.202
Supervisory Level versus Source Selection Experience	66.54	.00	.189

TABLE VIII

Group Relative Weights

Group	Technical	Operational	Logistics	Management	Cost	R^2
Overall Group (A)*	.245	.233	.250	.179	.197	.363
Overall Group (B)**	.330	.409	.060	.022	.179	.454
Supervisors (A)	.282	.226	.128	.149	.217	.439
Supervisors (b)	.276	.459	.084	.019	.163	.455
Program Managers (A)	.227	.237	.159	.191	.186	.336
Program Managers (B)	.353	.387	.051	.024	.186	.456
AEG (A)	.287	.211	.155	.165	.184	.575
AEG (B)	.275	.404	.068	.029	.225	.536
AEW (A)	.295	.228	.140	.177	.161	.416
AEW (B)	.322	.410	.076	.040	.153	.433
AER (A)	.133	.190	.147	.361	.170	.303
AER (B)	.318	.391	.065	.028	.197	.511
AEA (A)	.252	.271	.099	.067	.310	.223
AEA (B)	.359	.428	.020	.005	.187	.367
AEL (A)	.243	.259	.191	.116	.191	.509
AEL (B)	.361	.395	.076	.012	.156	.561

*A = No Policy

**B = With Policy

hand-calculated relative weights are presented in Table VIII. The group relative weights are not an average of individual relative weights. Rather, all group decisions were included in constructing a regression model for the group.

Consistency of Responses

H_1: Evaluation criteria are weighed consistently by personnel within AE.

R^2 measures how consistently individuals weighed evaluation criteria. A statistical test for R^2 was presented under the section dealing with pre-test. Individual R^2's are presented in Appendix F. As presented there, Case 48A was the only one which was insignificant from a statistical point of view. It fell below the minimum R^2 requirement of .322. In addition to looking at individuals, the average of all individuals and the overall group R^2's are presented in Table IX.

None of the figures in Table IX fall below the computed R^2 figure of .322. Thus personnel within AE appeared to be internally consistent in weighing evaluation criteria. Hypothesis one cannot be rejected. The lower R^2 for the overall group indicates that diverse policies exist in how individuals utilize evaluation criteria.

Measuring Differences in Groups

H_2: There are no differences among AE three letter groups with respect to source selection decisions.

H_3: There is no difference in source selection decisions made by program managers and their direct supervisors.

Chow's F-test was used to test hypotheses two and three. For a hypothesis to be rejected, F_o, the computed F-value, must be greater

TABLE IX

Average of Individuals and Overall Group R^2's

Overall	R^2 - No Policy	R^2 - With Policy
Group Regression	.363	.454
Average of Individual Regressions	.820	.855

than F_α, the F-value from statistical tables. F_α is determined by the level of significance (.05), the numerator degrees of freedom, and the denominator degrees of freedom. The results are shown in Table X. The results would indicate rejection of H_2; there are differences in three letter groups in AE with respect to source selection. The results support H_3; there is no difference in source selection decisions made by program managers and their direct supervisors. The results of an additional test not related to a specific hypothesis are also presented at the bottom of Table X. A test for differences in source selection versus no source selection experience was conducted. There was a significant difference in the decision making of those who had participated in source selection and those who had not.

Deletion of Cues

> H_4: Source selection decisions, in the aggregate, are highly predictable using only two or three of the evaluation criteria.

To examine this hypothesis it was decided that any cue or combination of the cues, which accounted for less than ten percent of the decisions, was considered to not contribute sufficiently to the rating a proposal received. Group results will be presented first. Then, results for individuals will be presented. Cues were inspected by contribution to relative weights. In Table XI group results are presented. In addition to these results, individuals were also examined. For individuals there was no consistent pattern to the cues which could be dropped. So, percentages were computed for individuals. These percentages represent the number of subjects which can be represented with three cues or less. For these subjects, the cue or combination of cues deleted accounted

TABLE X

Results of Chow's F Statistic Testing for
Differences in Group's Decision Models

H_2: No Differences Among Three Letter Groups (Without Policy)

Comparison Groups	F_o	$F_{.05}$	Reject H_2?
AEG/AEW/AER/AEA/AEL	5.15	1.52	YES
AEG/AEW	3.44	1.75	YES
AEG/AER	4.23	1.75	YES
AEG/AEA	6.10	1.75	YES
AEG/AEL	3.30	1.75	YES
AEW/AER	.93	1.75	NO
AEW/AEA	3.09	1.75	YES
AEW/AEL	.21	1.75	NO
AER/AEA	2.18	1.75	YES
AER/AEL	1.16	1.75	NO
AEA/AEL	2.84	1.75	YES

H_2: No Differences Among Three Letter Groups (With Policy)

AEG/AEW/AER/AEA/AEL	3.22	1.52	YES
AEG/AEW	.78	1.75	NO
AEG/AER	2.24	1.75	YES
AEG/AEA	1.52	1.75	NO
AEG/AEL	3.30	1.75	YES
AEW/AER	.65	1.75	NO
AEW/AEA	1.39	1.75	NO
AEW/AEL	1.23	1.75	NO
AER/AEA	2.62	1.75	YES
AER/AEL	.26	1.75	NO
AEA/AEL	3.37	1.75	YES

TABLE X (Continued)

H_3: No Differences Between Supervisory Levels

Comparison Groups	F_o	$F_{.05}$	Reject H_3?
Supervisors/ Program Managers (Without Policy)	1.23	2.10	NO
Supervisors/ Program Managers (With Policy)	.94	2.10	NO
Test for Differences in Source Selection Experience			
Source Selection/ No Source Selection (Without Policy)	16.35	2.10	YES
Source Selection No Source Selection (With Policy)	3.25	2.10	YES

TABLE XI

Group Results-Cues Which Can Be Dropped

No Policy

Group	Deletable Cues
Overall Group	None
Supervisors	None
Program Managers	None
AEG	None
AEW	None
AER	None
AEA	Management
AEL	None

With Policy

Overall Group	Logistics, Management
Supervisors	Logistics, Management
Program Managers	Logistics, Management
AEG	Logistics, Management
AEW	Logistics, Management
AER	Logistics, Management
AEA	Logistics, Management
AEL	Logistics, Management

for ten percent or less of the individual's decision. With no policy 14 of 58, or 24 percent of the subjects could be represented by three cues or less. With a policy, 36 of 58, or 62 percent of the subjects could be represented by three cues or less.

So, the results relating to H_4 are split. With no policy, it cannot be said that individuals or groups can be represented by two or three cues. With policy, individuals and groups can be represented using three cues.

Ability to Assimilate a Policy

H_5: Program managers and their direct supervisors will be able to assimilate a policy prioritizing evaluation criteria.

Spearman's Rho was calculated to evaluate H_5. The Rho value indicates how close a group was to the policy. Degree of conformity to the policy was measured before and after a policy was given. In Table XIII mean values of this Rho are presented and the results of a paired t-test on groups. The paired t-test indicates whether or not a group changed significantly to conform to the policy. The t-statistic indicates a significant change toward the policy in all groups. H_5 is supported; program managers and their direct supervisors were able to assimilate a policy prioritizing evaluation criteria.

Degree of Policy Assimilation

H_6: Program managers and their immediate supervisors will assimilate and apply a policy to the same degree.

H_7: Three letter groups will assimilate a policy to the same degree.

Group means of the Spearman Rho values (with policy) were presented in Table XII. In Table XIII the results of a t-test to test for differences in group means is presented. The t-test indicates whether or not there is a significant difference in how two groups applied a policy. The means tested were computed from Spearman Rho values with policy.

H_6 and H_7 cannot be rejected. There is no significant difference in how any of the groups assimilated the policy.

In addition to the t-tests on groups, individual's relative weights were inspected for conformance to the policy. Individual relative weights were first inspected for exact conformance to the policy. Then, various combinations of relative weights were allowed to shift up or down. The total effect on relative weights was not allowed to exceed .05. Thus, if the relative weight for one cue went up .05, the relative weight for another cue or combination of cues must shift down .05. The results are presented in Table XIV.

The individual results indicate an approximately 70 percent degree of conformance or near conformance to the policy.

Tests for Non-Linearity

H_8: There is negligible difference in the amount of variance explained by linear and non-linear models.

In Table XV, R^2 with and without inclusion of interaction terms is presented. Increase in R^2, due to incorporating interaction terms, is indicated.

Increases when incorporating interaction terms are meager at best. H_8 is strongly supported. There is negligible increase in the amount of variance explained by the non-linear models.

TABLE XII

Group Means and Paired t-Tests

Group	Mean-No Policy	Mean-With Policy	t_o	Significance Level	t_α	Reject H_5?*
Supervisors	.42	.87	-3.79	.001	-1.645	NO
Program Managers	.28	.79	-8.08	.000	-1.645	NO
AEG	.23	.89	-3.14	.013	-1.645	NO
AEW	.28	.80	-4.84	.000	-1.645	NO
AER	.23	.88	-4.60	.001	-1.645	NO
AEA	.38	.71	-3.56	.002	-1.645	NO
AEL	.51	.85	-3.99	.002	-1.645	NO

*H_5: Program Managers and their direct supervisors will be able to assimilate a policy prioritizing evaluation criteria.

TABLE XIII

t-Test of Group Means to Identify Differences
in Ability to Assimilate a Policy

Comparison Groups	t_o	Significance Level	$t_{.05}$	Reject H_6 or H_7?
Supervisors/ Program Managers	-1.11	.272	-1.645	NO
AEG/AEW	.86	.472	1.729	NO
AEG/AER	.18	.857	1.746	NO
AEG/AEA	1.12	.278	1.746	NO
AEG/AEL	.43	.666	1.771	NO
AEW/AER	-.87	.410	-1.706	NO
AEW/AEA	.58	.566	1.706	NO
AEW/AEL	-.56	.618	-1.714	NO
AER/AEA	1.10	.288	1.714	NO
AER/AEL	.34	.741	1.725	NO
AEA/AEL	-.93	.368	-1.725	NO

TABLE XIV

Group Conformance to Policy

	AEG	AEW	AER	AEA	AEL	Supervisors	Program Managers
Number of Subjects	6	16	13	13	10	17	41
Exactly Conforming	2	8	5	4	2	7	14
Conforming Within ± .05	2	4	5	4	4	6	13
Total Number Conforming	4	12	10	8	6	13	27
Percent Conforming	67	75	77	62	60	76	66

TABLE XV

A Comparison of R^2-With Interaction Terms and Without

No Policy

Model	Overall Group	AEG	AEW	AER	AEA	AEL	Supervisors	Program Managers
Linear	.363	.575	.416	.303	.472	.509	.439	.336
Inter-action	.364	.578	.419	.310	.491	.513	.445	.337
Increase	.001	.003	.003	.007	.019	.004	.006	.001

With Policy

Linear	.454	.536	.433	.511	.606	.561	.455	.675
Inter-action	.457	.544	.439	.514	.612	.566	.460	.677
Increase	.003	.012	.006	.003	.006	.005	.005	.002

In Chapter IV, Summary, Conclusions, and Recommendations, are presented. The aim of this chapter is to discuss how AE personnel rated proposals and examine any unusual results which occurred.

CHAPTER IV

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Summary

This thesis was concerned with examining how program managers and supervisors make source selection decisions. A specific organization with Aeronautical Systems Division, the Deputy for Aeronautical Equipment (AE) was the focus of this source selection investigation. Because of time limitations, only AE could be administered the exercise.

Five evaluation criteria were identified: technical, operational, logistics, management, and cost. Two levels were provided for each of these cues: adequate or excellent. Program managers and supervisors were then asked to rate/evaluate several proposals, one set of proposals when no guidance on the relative importance of the criteria was provided and another set with guidance.

The results of the exercise were critically examined. Analysis and results applicable to several specific hypotheses were presented.

Consistency in rating proposals among individuals and among sub-groups was examined. Demographic groups were then compared for differences in how they rated proposals. Predictability of proposal ratings was considered; i.e., strengths of specific evaluation criteria in explaining the decision model. Program managers, supervisors, and three letter groups were considered for policy assimilation; i.e., how well they were able to follow guidance on relative importance of evaluation criteria. Last, a non-linear model was constructed and compared to the standard linear model which was used.

Conclusions

The results were extremely interesting. In most cases the hypotheses were strongly supported or rejected. As in past research efforts, not all of the cues were necessary to adequately model a decision. Thus, people do not always use all the information available to them in making a decision.

Evaluation criteria were consistently weighed by all but one individual and all but one group, as indicated by R^2's. The lower values of group R^2's indicate that individuals have differing policies. The exercise allowed each individual maximum freedom of choice and anonymity.

There were differences in how three letter groups rated proposals. This is not surprising because each three letter group has a different function and performs different types of procurement. AE is very diverse and interests within it vary widely. AEG and AEA perform similar types of source selections as do AER, AEW, and AEL. The results showed that AEG and AEA rated proposals similarly but different from the similar rating policies of AER, AEW, and AEL.

Hypothesis four results are interesting. Decisions were predictable with three criteria when individuals were given a policy. However, decisions were not predictable when no policy was given. A possible explanation for this is that evaluation criteria are always prioritized in an RFP. Perhaps the subjects were more comfortable when given a policy.

All groups examined significantly shifted toward the policy. However, there was not a statistically significant difference in the degree to which they incorporated the policy. This seems unusual. One would

expect groups to have differences in ability to perform a task; i.e., incorporating a policy. Yet no significant differences were uncovered. A possible explanation is that they all did well in accomplishing a not too difficult task.

The non-linear model offered little improvement in R^2. So, the linear model is an adequate instrument to model this source selection decision. The simplicity of the linear model is what makes it so appealing. This thesis, as have many others, shows the linear model to be quite strong.

The results showed that differences in how three letter groups within AE rate proposals exist even with a prioritized listing of evaluation criteria. Management within AE might desire to have three letter groups make very similar decisions. The fact that differences exist implies that a proposal may receive different ratings in different three letter groups. This difference in ratings could possibly cause problems. To combat this, Lessons Learned briefings are conducted to identify and document past mistakes. The hope is to prevent future errors in judgment.

The result of no difference, in the degree to which supervisors and program managers assimilate a policy, is interesting. It is interesting because the indication is that supervisors do not do a better job than program managers in assimilating a policy. Supervisors and program managers may be doing an excellent job of communicating with each other. Thus, they do not differ in how they rate proposals.

Recommendations

Many other organizations in the Air Force and ASD participate in source selection. It would be interesting to examine more of them. With slight modifications the research exercise in this thesis could be used to do this. The exercise is simple and easy to complete.

In future distributions of the exercise, more demographic questions should be added. This would possibly enable explanation of things such as differences in three letter groups. Questions about how many years of experience and military versus civilian might be added. An additional question could be: Please state the typical size of source selections you are familiar with.

Bibliography

1. AEOI 70-2. Source Selection Procedures. Wright-Patterson AFB, Ohio: Deputy for Aeronautical Equipment, July 1978.

2. AFR 70-15. Source Selection Policy and Procedures. Washington: Department of the Air Force, April 1976.

3. AFR 70-15, AFSC Sup 1. Source Selection Policy and Procedures. Andrews AFB, District of Columbia: Headquarters Air Force Systems Command, February 1977.

4. AFR 70-15, ASD Sup 1. Source Selection Policy and Procedures. Wright-Patterson AFB, Ohio: Headquarters Aeronautical Systems Division, November 1978.

5. ASDP 800-7. Source Selection Guide. Wright-Patterson AFB, Ohio: Headquarters Aeronautical Systems Division, May 1978.

6. Beach, Lee Roy. "Multiple Regression as a Model for Human Information Utilization," Organizational Behavior and Human Performance, 2:276-289 (August 1967).

7. Bottenberg, Robert A. and Ward, Joe H., Jr. 6750th Personnel Research Laboratory, Air Force Systems Command. Defense Documentation Center Number AD413128:119 (March 1963).

8. Brehmer, Berndt. "Cognitive Dependence on Additive and Configurational One-Criterion Relations," Institute of Behavorial Science, 127:490-503 (June 1969).

9. Brunswik, E. "Thing Constancy as Measured by Correlation Coefficients," Psychological Review, 47:69-78 (1940).

10. Caro, Israel I. "Deputy for Aeronautical Equipment Request for Proposal (RFP) Preparation Guide," ASD Reserve Project Number 78-017-B1. Wright-Patterson AFB, Ohio: January, 1979.

11. Chow, Gregory C. "Tests of Equality Between Sets of Coefficients in Two Linear Regressions," Econometrica, 28:581-605 (July 1960).

12. Darlington, Richard B. "Multiple Regression in Psychological Research and Practice," Psychological Bulletin, 69:161-182 (March 1968).

13. Dawes, Robyn M. and Corrigan, Barnard. "Linear Models in Decision Making," Psychological Bulletin, 81:95-106 (February 1974).

14. Hammond, Kenneth R., et al. "Social Judgment Theory," Human Judgment and Decision Processes, edited by Martin F. Kaplan and Steven Schwartz. New York: Academic Press, Inc., 1975.

15. Hoffman, Paul J. "The Paramorphic Representation of Clinical Judgment," Psychological Bulletin, 57:116-131 (March 1960).

16. Jones, Kirk M., Mannis, Lawrence S., Martin, Lester R., Summers, Jay L. and Wagner, Gerald R. "Judgment Modeling for Effective Policy and Decision Making," Technical Report sponsored by the Air Force Office of Scientific Research, Air Force Systems Command. Defense Documentation Center Number AD-A033186 (December 1976).

17. McNichols, Charles W. Applied Multivariate Data Analysis. Dayton: Air Force Institute of Technology, 1978.

18. Mead, Donald F. "Development of an Equation for Evaluating Job Difficulty," Air Force Human Resources Laboratory, Air Force Systems Command. Defense Documentation Center Number AD 720253 (November 1970).

19. Mead, Donald F. and Christal, Raymond E. Air Force Human Resources Laboratory, Air Force Systems Command. Defense Documentation Center Number AD720255 (November 1970).

20. Mendenhall, William and Sheaffer, Richard L. Mathematical Statistics with Applications, North Scituate, Massachusetts: Duxbury Press, 1973.

21. Nie, H. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., and Bent, D. H. Statistical Package for the Social Sciences. New York: McGraw-Hill Book Company, 1975.

22. Slovic, Paul and Hoffman, Paul J. Oregon Research Institute. Defense Documentation Center Number AD688474 (May 5, 1969).

23. Slovic, Pual and Licktenstein, Sarah "Comparison of Bayesian and Regression Approaches to the Study of Information Processing in Judgment," Organizational Behavior and Human Performance, 6:649-744 (1971).

24. Taylor, Robert L. and Wilsted, William D. "Capturing Judgment Policies in Performance Rating," Industrial Relations, 15:216-224 (May 1976).

APPENDIX A

SOURCE SELECTION ACTIONS WITH AN EVALUATION COMMITTEE

1. Requirement Identified
2. New Start Review
3. SSA and SS Chairman Identified
4. Lessons Learned Meeting
5. Business Strategy Meeting
6. Initial Program Review
7. Sources Sought - CBD
8. Prepare Program Documentation/Prepare Executive Summary D&F
9. SS Plan Preparation/Coordination/Approval
10. RFP Preparation (including model contract)
11. RFP Coordination/Murder Board/Approval/Issued
12. Selection, Identification, Notification SSEC Members
13. Prepare Evaluation Standards/Criteria
14. Pre-Evaluation Meetings and Instructions
15. Bidders Briefing
16. Letters of Intent
17. Audit Request Prepared
18. Pre-Award Survey Request Prepared
19. EEO Request Prepared
20. Pricing Coordination
21. Administration Established
22. SS Facilities Planned
23. Receive/Screen Proposals
24. Evaluations
25. Audit/PAS/EEO Requests Sent

26. CI/DR/MR Transmittal Flow
27. Preparation of Evaluation Report
28. Fact Finding Discussions (Technical)
29. Revise Model Contracts
30. Preliminary Briefing to SSA
31. CI/DR/MR Flow Complete
32. Technical Evaluation Complete
33. Negotiation of Technical, Management, T&C
34. Cost Discussions
35. Model Contracts Completed
36. Preliminary Review
37. BAFO Request Issued
38. BAFO Received, Analyzed/Summarized
39. Summary Report Prepared
40. PAR Prepared
41. Final Review
42. Final Briefing to SSA
43. Decision Documents
44. Loser Letters/Contract Award
45. Debriefings
46. Lessons Learned

APPENDIX B

SOURCE SELECTION EXERCISE

SUBJECT: Source Selection Exercise 16 May 1979

TO: ASD/AE Program Managers and Supervisors

1. We have made arrangements for our organization to participate in a "policy capturing" exercise with an AFIT student. Policy capturing is a technique which has been used successfully to evaluate decision making processes. It has been used at the Air Force Adademy, within Air Force Communications Service, and within Air Training Command.

2. Instructions for completing the exercise are provided on succeeding pages. The exercise is composed of three parts.

3. Your participation is strictly voluntary and anonymous. If you put your name on the exercise, you will be provided the decision model formulated from your responses. You need not identify yourself unless you want to be advised as to the results of the research.

4. When you have completed the exercise, place it in the addressed envelope provided and drop it into base mail. A high response rate is needed to build a representative decision model. Thank you for your response.

Francis W. Penney

F.W. Penney, Colonel, USAF
Assistant Deputy
Deputy for Aeronautical Equipment

1 Atch
Source Selection
Exercise

A SOURCE SELECTION EXERCISE FOR PROGRAM MANAGERS
IN THE DEPUTY FOR AERONAUTICAL EQUIPMENT

THIS IS NOT A QUESTIONNAIRE. It is a source selection exercise to investigate how program managers utilize evaluation criteria in evaluating proposals. The data collected will support a research effort sanctioned by AE and a master's thesis at the Air Force Institute of Technology but you will not be identified in the final report. Your cooperation is, therefore, sincerely requested. Your input to this research will be kept strictly confidential.

The dollar amount of each proposal to be evaluated in this exercise is $400,000. Thus, none of the formal committees (Source Selection Advisory Council, Source Selection Evaluation Board, and Source Selection Evaluation Committee) exist for this exercise. The Source Selection Authority rests with the Procuring Contracting Officer.

The exercise is divided into three sections. In Section I you are asked to identify your organization. Section II involves evaluating proposals with respect to several evaluation criteria. The evaluation criteria are intentionally not prioritized in this section. In Section III a policy is stated in relation to the evaluation criteria. You are then asked to evaluate additional proposals. The stated policy should be considered when evaluating proposals.

There are no "correct" or "incorrect" answers so please respond as candidly as possible. The information provided by you and other respondents will be combined to statistically test hypotheses about how information is used by program managers in AE to evaluate offerors' proposals. Each individual's exercise will be destroyed once the responses have been keypunched onto computer cards. This is your opportunity to contribute to an experimental analysis of part of the source selection process.

ALL DECISIONS RELATE TO EVALUATING PROPOSALS

Please return this exercise within ten days so that it may be included in the research. Write any comments you may have on the last page. Thank you.

PRIVACY STATEMENT

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the Privacy Act of 1974.

a. Authority
(1) 4 U.S.C. 301, Departmental Regulations: and/or

(2) 10 U.S.C. 80-12, Secretary of the Air Force, Powers and Duties, Delegation by.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Routine Uses. The survey data will be converted to information for use in research of management related problems. Results of the research based on the data provided, will be included in written Master's thesis and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on the survey data, whether in written form or orally presented, will be unlimited.

d. Participation in this survey is entirely voluntary.

e. No adverse action of any kind may be taken against an individual who elects to participate in any or all of this survey.

I. ORGANIZATION

A. Please indicate your organization by checking the appropriate space provided.

AEG _____
AEW _____
AER _____
AEA _____
AEL _____

B. Are you a supervisor of program managers?

YES _____
NO _____

C. Have you ever been involved in an actual source selection?

YES _____
NO _____
If so, about how many? _____

II. SOURCE SELECTION EXERCISE INSTRUCTIONS

This section consists of a source selection exercise. During the exercise, you should assume that you are responsible for evaluating offerors' proposals. The only real differences in these proposals are the degree to which each individual evaluation criteria is met or exceeded. Assume the proposals do not differ on other attributes.

These five evaluation criteria are described as ADEQUATE or EXCELLENT. Each proposal has been rated in relation to these criteria. For this exercise ADEQUATE means "MEETS MINIMALLY ACCEPTABLE VALUE OR REQUIREMENT." EXCELLENT means "CONSIDERABLY BETTER THAN MINIMALLY ACCEPTABLE VALUE OR REQUIREMENT."

An explanation of the evaluation criteria is presented below. They apply to all decisions. Proposals which fall between adequate and excellent are not a part of this exercise.

--Technical. This refers to the soundness, technical merit, and level of risk of the specific design chosen. It is measured as the degree to which technical qualities meet or exceed specifications in all technical areas.

--Operational. This refers to the functional performance of the proposed system to meet the requirements of the military mission. It is measured as the degree to which estimated performance meets or exceeds all performance specifications.

--Logistics. This refers to the supportability of the proposed system. It is reflected in the extent of attention to the reliability/maintainability characteristics of design. It is measured as the degree to which estimated mean time to repair and mean time between failures meets or exceeds standards.

--Management. This refers to the qualifications of the offerors' management personnel and the evidence of adequate planning and control efforts. It is measured by the extent of evidence in the proposal of good management planning and control systems and by the offerors' past record of contract performance.

--Cost. This refers to the current best estimates of life cycle cost and the soundness of the contract cost estimates. It is measured as the degree to which sound estimates are within cost targets.

For each proposal, you will be provided ratings in relation to each of the five evaluation criteria. You will then be asked to evaluate the proposal. Indicate your evaluation of each proposal on the scale below it. A sample scale is presented below.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

You should circle the number that best indicates your evaluation of each proposal. Make each decision one at a time and independently of the others. Do not change a decision once you have made it. Work at a brisk pace, but don't hurry your decisions. Complete EVERY case, as each case is DIFFERENT. The proposals begin on the following page.

Note: The evaluation criteria are intentionally not prioritized in this section. Order of listing has no significance.

PROPOSAL #1

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #2

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #3

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #4

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #5

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #6

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #7

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #8

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #9

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #10

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #11

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #12

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #13

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #14

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #15

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #16

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #17

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #18

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #19

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #20

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #21

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #22

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #23

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #24

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #25

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #26

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #27

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #28

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #29

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #30

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #31

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #32

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

III. POLICY STATEMENT

The evaluation criteria are listed in decreasing order of importance. This priority applies when evaluating all proposals in this section.

1. Operational
2. Technical
3. Cost
4. Logistics
5. Management

All instructions in Section II also apply to this section, except in relation to priority of evaluation criteria. However, DO NOT refer to the proposals in Section II when evaluating the proposals in this section. The proposals begin on the following page.

PROPOSAL #1

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #2

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #3

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #4

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #5

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #6

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #7

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #8

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #9

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #10

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #11

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #12

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #13

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #14

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #15

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #16

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #17

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #18

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #19

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #20

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #21

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #22

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #23

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #24

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #25

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #26

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #27

Technical ..... EXCELLENT
Operational ..... ADEQUATE
Logistics ..... ADEQUATE
Management ..... EXCELLENT
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #28

Technical ..... ADEQUATE
Operational ..... ADEQUATE
Logistics ..... EXCELLENT
Management ..... EXCELLENT
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #29

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #30

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... ADEQUATE
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #31

Technical ..... EXCELLENT
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... ADEQUATE

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

PROPOSAL #32

Technical ..... ADEQUATE
Operational ..... EXCELLENT
Logistics ..... EXCELLENT
Management ..... ADEQUATE
Cost ..... EXCELLENT

Indicate below your overall evaluation of this proposal.

0 1 2 3 4 5 6 7 8 9 10

Highly Undesirable — Highly Desirable

OPTIONAL:

Name _____

Comments _____

_____

_____

_____

APPENDIX C

ORTHOGONAL VECTORS ASSOCIATED WITH RATINGS OF EXCELLENT (E) OR ADEQUATE (A) FOR A SET OF THE FIVE EVALUATION CRITERIA

With No Stated Policy

Proposal Number	Ratings	Orthogonal Vectors
1	A A A E A	0 0 0 1 0
2	E A A E E	1 0 0 1 1
3	E E E E E	1 1 1 1 1
4	A E A A A	0 1 0 0 0
5	A A E E A	0 0 1 1 0
6	A E E A A	0 1 1 0 0
7	A E E E A	0 1 1 1 0
8	E A E E E	1 0 1 1 1
9	E E E A E	1 1 1 0 1
10	E A E A E	1 0 1 0 1
11	E E A E E	1 1 0 1 1
12	E A A A E	1 0 0 0 1
13	A E A E A	0 1 0 1 0
14	A A E A A	0 0 1 0 0
15	A A A A A	0 0 0 0 0
16	E E A A E	1 1 0 0 1
17	A A E E E	0 0 1 1 1
18	E A E E A	1 0 1 1 0
19	E A E A A	1 0 1 0 0
20	E E A A A	1 1 0 0 0
21	A E E E E	0 1 1 1 1
22	E E E A A	1 1 1 0 0
23	E E E E A	1 1 1 1 0
24	A E E A E	0 1 1 0 1
25	A E A A E	0 1 0 0 1
26	A A A A E	0 0 0 0 1
27	E E A E A	1 1 0 1 0
28	A E A E E	0 1 0 1 1
29	E A A E A	1 0 0 1 0
30	A A A E E	0 0 0 1 1
31	E A A A A	1 0 0 0 0
32	A A E A E	0 0 1 0 1

With a Stated Policy

Proposal Number	Ratings	Orthogonal Vectors
1	A E E E A	0 1 1 1 0
2	A E A E A	0 1 0 1 0
3	A A E A A	0 0 1 0 0
4	E E E A E	1 1 1 0 1
5	E A E A E	1 0 1 0 1
6	E E A A E	1 1 0 0 1
7	A A A E A	0 0 0 1 0
8	A A A A A	0 0 0 0 0
9	A E E A A	0 1 1 0 0
10	E A A E E	1 0 0 1 0
11	A A E E A	0 0 1 1 0
12	E E A E E	1 1 0 1 1
13	A E A A A	0 1 0 0 0
14	E A E E E	1 0 1 1 1
15	E A A A E	1 0 0 0 1
16	E E E E E	1 1 1 1 1
17	E A A A A	1 0 0 0 0
18	E A E A A	1 0 1 0 0
19	E A E E A	1 0 1 1 0
20	A E A E E	0 1 0 1 1
21	E E A E A	1 1 0 1 0
22	E E E E A	1 1 1 1 0
23	A A E A E	0 0 1 0 1
24	A E E E E	0 1 1 1 1
26	A A A A E	0 0 0 0 1
26	A A A E E	0 0 0 1 1
27	E A A E A	1 0 0 1 0
28	A A E E E	0 0 1 1 1
29	A E A A E	0 1 0 0 1
30	E E A A A	1 1 0 0 0
31	E E E A A	1 1 1 0 0
32	A E E A E	0 1 1 0 1

APPENDIX D

LETTER EXTENDING THE EXERCISE CUTOFF DATE

SUBJECT: Source Selection Exercise 20 Jun 1979

TO:

1. If you have already completed and returned the source selection exercise, please disregard this letter.

2. Due to TDY, leave, and heavy workloads, the cutoff date for completing this exercise is being extended. Those exercises which are completed and placed in the mail by June 26 will be included in the research. Please consider completing the exercise by this date. Additional exercises will be greatly appreciated. Thank you for your response.

John N. Milligan

John N. Milligan, Captain, USAF
AFIT/ENS

AD-A076 158 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOO--ETC F/G 15/5
A CRITICAL APPRAISAL OF SOURCE SELECTION PROCEDURES.(U)
SEP 79 J N MILLIGAN
UNCLASSIFIED AFIT/GSM/SM/79S-10 NL

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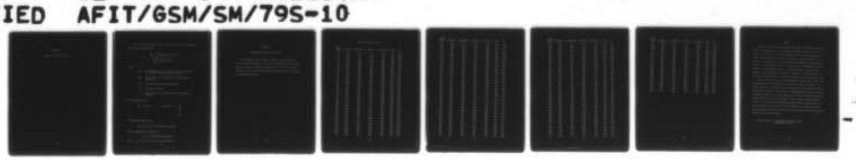

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APPENDIX E

CALCULATION OF F-TEST VALUES

The F-test values used to compare regression models were calculated using the following formula:

$$F_o = \frac{[SS_e - \sum_{i=1}^{p} SS_{ej}]/[(p-1)(k+1)]}{[\sum_{j=1}^{p} SS_{ej}]/[n-p(k+1)]}$$

where

SS_e = the residual sum of squares derived by regressing all compared groups of decisions together

SSe_j = the residual sum of squares for the jth group of evaluations

p = the number of groups being compared

k = the number of cues

n = the total number of decisions in all groups being compared

The null hypothesis is:

$$H_o: \underline{B}_1 = \underline{B}_2 = \ldots = \underline{B}_p, \text{ where } \underline{B}_i = \begin{matrix} B_o \\ B_i \\ \vdots \\ B_k \end{matrix}$$

The alternate hypothesis is:

$$H_a: \underline{B}_i \neq B_j, \text{ for at least one i,j pair.}$$

The null hypothesis is rejected if

$$F_o > F_\alpha, [(p-1)(k+1)], [n-p(k+1)$$

where $\alpha = .05$ for all comparisons in this study.

APPENDIX F

INDIVIDUAL RELATIVE WEIGHTS AND R^2

In this Appendix the individual relative weights and R^2's are listed. On the case numbers, A is for the second part of the exercise (no stated policy in relation to the evaluation criteria), while B is for the third part of the exercise (with a stated policy in relation to the evaluation criteria).

Relative Weights for Cues

Case Number	Technical	Operational	Logistics	Management	Cost	R^2
1A	.330	.179	.154	.205	.132	.895
1B	.333	.333	.333	.000	.000	1.000
2A	.061	.409	.119	.002	.409	.497
2B	.272	.345	.038	.000	.345	.773
3A	.200	.200	.200	.200	.200	.995
3B	.200	.200	.200	.200	.200	.995
4A	.025	.099	.069	.796	.111	.511
4B	.558	.037	.022	.383	.000	.789
5A	.200	.200	.200	.200	.200	1.000
5B	.301	.301	.048	.048	.301	.912
6A	.200	.200	.200	.200	.200	1.000
6B	.408	.283	.181	.102	.025	.929
7A	.018	.008	.294	.018	.661	.833
7B	.350	.197	.022	.022	.410	.831
8A	.059	.470	.416	.015	.041	.879
8B	.224	.439	.129	.018	.190	.861
9A	.160	.360	.160	.160	.160	.568
9B	.160	.360	.160	.160	.160	.568
10A	.152	.422	.207	.068	.152	.780
10B	.288	.648	.026	.012	.026	.116
11A	.402	.402	.114	.041	.041	.888
11B	.365	.365	.096	.096	.078	.827
12A	.413	.096	.096	.093	.300	.780
12B	.366	.435	.003	.003	.193	.836
13A	.097	.181	.136	.354	.232	.916
13B	.200	.200	.200	.200	.200	1.000
14A	.437	.241	.055	.102	.164	.738
14B	.438	.401	.053	.007	.100	.899
15A	.200	.200	.200	.200	.200	1.000
15B	.339	.461	.085	.000	.115	.916

Case Number	Technical	Operational	Logistics	Management	Cost	R^2
16A	.374	.517	.032	.332	.105	.710
16B	.315	.540	.025	.010	.110	.912
17A	.000	.685	.304	.008	.002	.845
17B	.227	.512	.101	.002	.158	.685
18A	.000	.015	.026	.944	.015	.778
18B	.301	.450	.182	.033	.033	.906
19A	.382	.165	.000	.382	.070	.397
19B	.459	.247	.001	.001	.294	.879
20A	.210	.036	.093	.286	.374	.844
20B	.203	.406	.141	.013	.238	.824
21A	.259	.353	.065	.065	.259	.808
21B	.173	.629	.013	.013	.173	.844
22A	.215	.176	.141	.059	.410	.856
22B	.181	.407	.229	.045	.138	.727
23A	.335	.067	.032	.020	.546	.867
23B	.329	.404	.006	.000	.261	.912
24A	.432	.185	.087	.148	.148	.858
24B	.317	.317	.073	.021	.272	.349
25A	.257	.348	.158	.137	.099	.972
25B	.318	.318	.121	.105	.138	.977
26A	.218	.173	.218	.173	.218	.937
26B	.325	.138	.006	.015	.516	.894
27A	.041	.018	.005	.649	.288	.771
27B	.249	.520	.003	.077	.151	.768
28A	.093	.658	.208	.000	.041	.840
28B	.231	.453	.009	.009	.297	.456
29A	.220	.170	.194	.220	.194	.985
29B	.169	.470	.052	.008	.301	.684
30A	.281	.281	.146	.070	.222	.925
30B	.244	.549	.077	.015	.115	.919
31A	.326	.281	.060	.166	.166	.845
31B	.347	.347	.003	.000	.303	.915
32A	.567	.225	.019	.094	.094	.878
32B	.291	.406	.087	.022	.195	.948

Case Number	Technical	Operational	Logistics	Management	Cost	R^2
33A	.251	.251	.123	.123	.251	.959
33B	.250	.490	.090	.010	.160	.962
34A	.295	.244	.156	.061	.244	.827
34B	.214	.433	.134	.048	.172	.885
35A	.147	.376	.094	.288	.094	.833
35B	.302	.428	.055	.017	.198	.900
36A	.099	.099	.537	.206	.060	.790
36B	.693	.102	.066	.037	.102	.762
37A	.142	.033	.053	.705	.065	.887
37B	.248	.199	.044	.333	.176	.758
38A	.122	.151	.255	.217	.255	.813
38B	.159	.159	.185	.311	.185	.930
39A	.231	.180	.180	.231	.180	.980
39B	.187	.494	.105	.026	.187	.864
40A	.093	.093	.060	.302	.451	.322
40B	.321	.570	.023	.036	.051	.711
41A	.713	.070	.070	.011	.136	.882
41B	.345	.417	.014	.003	.221	.824
42A	.460	.079	.062	.200	.200	.852
42B	.303	.400	.034	.004	.260	.906
43A	.415	.157	.120	.061	.246	.822
43B	.205	.589	.031	.003	.171	.882
44A	.200	.200	.200	.200	.200	1.000
44B	.225	.426	.173	.088	.088	.780
45A	.088	.477	.119	.119	.197	.873
45B	.315	.485	.013	.041	.146	.921
46A	.281	.281	.281	.079	.079	.900
46B	.321	.321	.018	.018	.321	.923
47A	.379	.333	.120	.095	.073	.983
47B	.216	.533	.083	.049	.110	.965
48A	.742	.061	.000	.136	.061	.280
48B	.444	.277	.060	.011	.208	.674
49A	.178	.274	.240	.034	.274	.831
49B	.342	.418	.024	.004	.213	.838

Case Number	Technical	Operational	Logistics	Management	Cost	R^2
50A	.490	.107	.035	.054	.314	.871
50B	.307	.371	.077	.049	.196	.937
51A	.224	.370	.018	.224	.164	.553
51B	.181	.636	.011	.071	.102	.870
52A	.212	.492	.212	.048	.099	.821
52B	.340	.340	.085	.012	.224	.947
53A	.200	.200	.200	.200	.200	1.000
53B	.326	.455	.007	.024	.187	.854
54A	.105	.160	.131	.498	.105	.968
54B	.293	.463	.068	.015	.161	.978
55A	.300	.097	.063	.300	.239	.893
55B	.298	.265	.070	.070	.298	.847
56A	.187	.332	.332	.002	.147	.624
56B	.468	.208	.081	.007	.235	.897
57A	.122	.186	.186	.152	.354	.757
57B	.209	.372	.134	.015	.269	.883
58A	.205	.205	.164	.127	.300	.869
58B	.277	.316	.145	.050	.206	.877

VITA

Captain John N. Milligan was born in Oak Ridge, Tennessee, on January 4, 1948. He graduated from Sandia High School in 1966 at Albuquerque, New Mexico. He entered the University of New Mexico in 1966 and graduated in 1971. While at the University, he majored in mathematics and minored in chemistry. He was a member of Kappa Mu Epsilon, mathematics honorary, and the American Chemical Society. He was also a member and officer in Phi Gamma Delta, a national social fraternity. In 1974, Captain Milligan entered Louisiana Tech University at Bossier City, Louisiana. In August, 1979 he received the degree of Master of Business Administration from Louisiana Tech.

Captain Milligan entered the United States Air Force in June, 1971, after being commissioned through the Reserve Officer Training Corps program. His first assignment was navigator training at Mather Air Force Base, California. He graduated in October, 1972. Then, he entered Navigator-Bombadier Training at Mather Air Force Base. After graduation in February, 1973, he was assigned to Barksdale Air Force Base, Louisiana. He has completed Squadron Officer School and Air Command and Staff College through correspondence programs. He was assigned to the Air Force Institute of Technology in August, 1978. Following graduation, he will be assigned as a Systems Program Manager at Wright-Patterson Air Force Base, Ohio.

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